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Discovery of a New Planet. By M. Luther.

Mr. Hind has received a letter from M. Luther, dated October 8, announcing his discovery of a new planet at Bilk, on the 5th of the same month. It was situate in 2° 25′ of right ascension, and 0° 52′ of north declination, and resembled a star of the tenth magnitude. On the following evening he obtained this observation of it:—

	M.T. Berlin.	R.A.	N. Decl.
1855.	h m s	° ′ ″	° ′ ″
Oct. 6.	8 44 14·4	2 12 21·4	+0 49 18·2

This planet has received the designation of *Fides*, with the symbol of a cross.

On certain Anomalies presented by the Binary Star 70 Ophiuchi.
By Capt. W. S. Jacob, Madras Astronomer.

The pair of stars designated as 70 *Ophiuchi* have been long recognised by astronomers as a binary system, but the authorities are not as yet agreed as to the exact orbit, although only about 20° are wanting to complete the whole ellipse since they were first measured by Sir W. Herschel in 1779.

Many hypothetical orbits have been computed, all of which fail at certain points in representing the observed quantities as closely as might be expected: thus, in some that have lately appeared, while the angles show a tolerably near agreement with observation, the distances are entirely thrown out, the maximum being represented as yet future; whereas, observation indicates a steady decrease in distance since 1848 or 1850, the quantity now amounting to 0″·50; any attempt, however, to alter the elements so as to bring the distances into better agreement, throws a considerable increase of error on the angles. There is, further, this remarkable point to be noticed, viz., that even in those orbits in which the distances are neglected, and the angles made to agree as closely as possible, the errors assume somewhat of a periodical or epicyclical form, continuing to have the same sign over a considerable extent of the orbit, and this is still more strongly marked when both angles and distances are taken into account. Thus, in an orbit which I have lately computed with a period of 93 years, the errors are + from 1820 to 1823, — with one exception from 1823 to 1830; from 1830 to 1832 there is a turning point, where the errors alternate; and from 1833 to 1842, they are again +; and from 1846 to the present time they are for the most part —.

Now such systematic errors can hardly be casual; they must

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depend upon some law. It is just possible that they might arise from an erroneous assumption of the universal application of the law of gravitation; this law may be somewhat modified in these remote systems: the general evidence of observation is in favour of the law being everywhere the same as it is within the solar system, but the data are not exact enough to define this with certainty.

But there is a simpler mode of accounting for the discrepancy without having recourse to any change of law. We may suppose a third body to belong to the system, and to be opaque, and consequently invisible; such a body would, of course, disturb the regularity of the motions of the other two.

The existence of such dark bodies has been already surmised, though not fully demonstrated in the cases of certain apparently single stars, such as *Sirius* and *Procyon.* The body in this case, if it be supposed to circulate as a planet round the smaller star, need not be very large, for the observed amount of deviation of the star from its regular orbit is less than 0″·1 of arc.

I have computed the corrections to be applied on the hypothesis of the secondary orbit described by the smaller star having a semi-major axis of 0″·08, and an excentricity of 0″·15, a periodic time of 26 years, and motion direct, which seems to be somewhat near the truth, for a great improvement is at once manifested; without correction the average error of the angles in the interval from 1820 to 1855 is 49′, which is reduced by the corrections to 35′, or by more than one-fourth, while the maximum error is also reduced from 133′ to 94′. In the distance measures for the same interval the difference is less strongly marked, but the early measures are not worthy of much confidence; and if we consider only the time subsequent to 1838, which includes all the best measures, we find the average error reduced from 0″·14 to 0″·11, and the maximum from 0″·26 to 0″·19, being about the same proportion as above.

There is, then, some positive evidence in favour of the existence of a planetary body in connexion with this system, enough for us to pronounce it highly probable, and certainly good ground for watching the pair closely, to procure, if possible, still stronger evidence.

The corrections have not been applied to the three first observations, being those of Sir W. Herschel; these being isolated points, could be easily brought into agreement by a slight change of the elements, and would, therefore, furnish no test of the accuracy of the hypothesis.

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Comparison of the Orbit of 70 Ophiuchi, with Observations.

Epoch.	Observed Position Angles.	Computed — Observed.	Error Corrected.*	Observed Distance.	Computed Distance.	Error.	Error Corrected.*
	° ′	′		″	″	″	″
1779·77	90 0	+ 5	...	4·49	4·67		
1802·34	336 8	−136	...				
1804·41	318 48	+ 12	...	2·56	2·44		
1820·31	161 27	+133	+65				
1821·51	156 50	+107	+67				
1822·54	154 30	+ 25	+14				
1823·32	153 25	− 50	−41				
1825·56	148 12	− 92	−44	4·38	4·29		
1826·75	146 24	−133	−80				
1827·40	143 54	− 64	−10	4·51	4·64		
1828·67	140 18	+ 13	+67	4·79	4·87		
1829·50	139 30	− 23	+23	5·18	5·00		
1830·36	138 9	− 22	+ 8				
1830·50	137 28	+ 6	+35	5·65	5·20		
1830·76	136 24	+ 46	+71	5·43	5·24		
1831·55	136 8	− 5	+ 8	5·97	5·37		
1832·55	133 46	+ 53	+53	5·73	5·52		
1832·57	135 31	− 54	−54	5·50	5·52		
1833·42	132 49	+ 43	+33	6·14	5·65		
1833·59	132 30	+ 49	+37	5·98	5·68		
1835·56	130 36	+ 17	−13	5·97	5·91		
1836·81	128 36	+ 52	+12	6·33	6·05		
1837·64	127 30	+ 63	+19	6·40	6·14		
1838·51	126 30	+ 67	+20	6·25	6·22	−·03	−·05
1842·55	122 24	+ 67	+27	6·68	6·57	−·11	−·06
1846·21	120 10	− 2	− 2	6·83	6·64	−·19	−·11
1848·12	118 50	− 27	−10	6·80	6·66	−·14	−·06
1850·48	115 11	+ 64	+94	6·86	6·65	−·21	−·17
·66	117 0	− 55	−23	6·50	6·64	+·14	+·16
1852·75	114 3	+ 5	+40	6·73	6·61	−·12	−·13
1853·60	114 39	− 77	−46	6·49	6·58	+·09	+·05
1854·08	113 39	− 44	−16	6·36	6·57	+·21	+·16
1854·24	113 2	− 16	+10	6·51	6·57	+·06	+·01
1854·73	113 43	− 84	−62	6·34	6·55	+·21	+·16
1855·45	111 35	+ 4	+21	6·26	6·52	+·26	+·19
		49	35			·14	·11

Elements of the Orbit of 70 Ophiuchi.

$\tau = 1808^{y}·12$

$\pi = 292°32'$

$☊ = 304·32$

$\lambda = -20\ 28$

$e = ·4894$

$\gamma = 55°16'$ cos = [9·7557]

$P = 93^{y}·10$

$n = 3°·867$

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* On the hypothesis of a secondary orbit, in which $a = 0''·08$, $e = 0·15$. $\pi = 200°$, $P = 26^{yr}$, $\tau = 1825·5$.